A Comparative Study Between Cheese From Cow and Goat's Milk Using Different coagulates

دراسة مقارنة بين الجبن المصنع من ألبان الأبقار وألبان الماعز بإستخدام مجبنات مختلفة

By:

Esraa Elfdial Hamid Elfdial

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Supervisor:

Dr. Bhagiel Taifour Bhagiel Ibrahim

Assistant Professor: Department of Animal Production –

College of Agriculture. Studies,

Sudan University of Science and Technology

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الآية

(وَإِنَّ لَكُمْ فِي الْأَنْعَامِ لَعِبْرَةً نُسْقِيكُمْ مِمَّا فِي بُطُونِهِ مِنْ بَيْنِ فَرْثٍ

وَدَمٍ لَبَنًا خَالِصًا سَائِغًا لِلشَّارِبِينَ)

صدق الله العظيم

(سورة النحل) (66)

DEDICATION

To my Family,

The Staff

and Colleagues.

Esraa

Acknowledgement

Firstly, all praise is to Allah for his unlimited support. Peace and blessing of Allah be to The Prophet and Messenger and his pious companion and followers.

I would like to express my sincere gratitude to my supervisor, ***Dr. BhagielTaifourBhagiel Ibrahim.*** *his kind support, supervision, guidance, valuable recommendations and continuous encouragement through my hardest times. Thanks and gratitude to our staff Randa her keen and valuable help throughout processin; and to all animal production laboratory staff, and very grateful thanks extended to Animal production department staff.*

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Abstract

This study was carried out to assess cheese produced from different milk; cows' and goats' milk during the period September to November (2014). The cow,s milk collected from experimental dairy farms of animal production college (Kuku). And goats milk collected from college of Agricultural studies (Shambat) Sudan University of science and Technology. After pasteurization at 85℃ for 30 min and cooling to 40℃ , the collected milk samples were divided into four groups (each five liters of goat's and cow's milk were treated with both Rennet enzyme and citric (Lemmon juice) respectively. Thereafter, the samples were incubated at 38℃ . It was found that the cow's and goat's milk which treated by rennet enzyme was coagulated in one hour incubation, while the cow's and goat's milk which treated by citric acid (lemon juice) was coagulated immediately in 10 min..

the physiochemical properties of the manufactured cheese was analyzed, whereas, the panel taste was done after 4 days of cheese making.

The results revealed significant ($p \leq 0.05$) differences between goat's and cow's cheese in physiochemical characteristics. However, no significant ($p \geq 0.05$) differences were reported in, Calcium and Phosphorus content of both goats's and cow's milk cheese.

Physiochemical characteristics (protein, fat, total solids (TS), acidity, ash, lactose and SNF) of goat's and cow's cheese induced significant differences ($p \leq 0.05$).

It was observed that acidic goat's milk cheese recorded higher protein, fat, ash, T.S, ph., TNF, percentages, while acidic cow's cheese showed high moisture,

lactose, Ca and acidity.While, enzymatic goat's cheese revealed high percentages, of protein, fat, ash, T.S, Ca and acidity, and enzymatic cow's cheese revealed high moisture, lactose, ph., TNF and Phosphorus percentage.

The sensory evaluations showed significant ($p \leq 0.05$) differences on taste, flavor, smell, texture, and overall acceptability.

The best values for taste, color and overall acceptability were obtained from enzymatic (rennet) goat's cheese followed by enzymatic (rennet) cow's cheese, then acidic (citric) cow's cheese and acidic (citric) goat's cheese was the last. The best readings concerning hardness and texture were obtained from enzymatic (rennet) cow's cheese then acidic (citric) cow's cheese, enzymatic (rennet) goat's cheese and acidic (citric) goat's cheese treatment respectively, whereas the best values of smell recorded by enzymatic (rennet) cow's cheese, then acidic (citric) cow's cheese, followed by acidic (citric) goat's cheese and then enzymatic (rennet) goat's cheese respectively. The better flavor was attained from the cheese manufactured from acidic (citric) cow's cheese, enzymatic (rennet) goat's cheese, enzymatic (rennet) cow's cheese and acidic (citric) goat's cheese respectively.

الخلاصة

اجريت هذه الدراسة لتقييم الجبنة المنتجة من لبن الماعز ولبن البقر بإستخدام التجبن الإنزيمي (إنزيم الرنين) والتجبن الحمضي باستخدام حامض الستريك(عصير الليمون)، وتم جمع العينات من لبن الماعز وعينات لبن البقر من مزرعة جامعة السودان للعلوم والتكنلوجيا ، حيث تم تحليل اللبن الطازج بمعمل جامعة السودان تم تقسيم اللبن الي 4 عينات كالاتي 5 لتر لبن ماعز واضافة انزيم الرنين و 5 لتر لبن ماعز باضافة حمض الستريك 305 مل من (عصير الليمون) و5 لتر لبن بقر واضافة انزيم الرنين له و 5 لتر لبن بقر باضافة حمض الستريك (عصير الليمون).

تم بسترتة اللبن علي درجة 85 درجة مئوية لمدة 30 دقيقة ثم تبريد الي 42 درجه مئوية بعدها تم إضافة إنزيم الرنين ثم ادخاله الي الحضان في درجة 38 درجة مئوية ثم الحصول على الجبنه الانزيمية بعد ساعة من دخولها الحضان اما الجبنة الحمضية بعد تسخينها مباشرة وبسترتها لمده 30 دقيقه واضافة حمض الستريك (عصير الليمون) 305مل تتكون الخثرة

(بعد 10 دقائق) وتصبح جبنة.ثم بعد ذلك حللت عينات الجبنة لمعرفة الصفات الفيزيائية والكيمائية كما تم إجراء اختبار التذوق واظهرت النتائج فروقات معنوية عالية بين انواع الجبنة في نسبة البروتين والجوامد الصلبة الكليه والفسفور والكالسيوم والرماد والدهن واللاكتوز،بين جبنة الماعز الحمضية والتي سجلت نسبة عالية من البروتين والدهن والرماد والفسفوروالجوامد الصلبة الكلية اما جبنة البقر الحمضية فقد أعطت نسبة عالية من الرطوبة واللاكتوز والحموضه واظهرت النتائج ايضا اختلاف بين جبنه الماعز الانزيمية فيها نسبة عالية من الكالسيوم والحموضة والبروتين والدهن والرماد وجبنة البقر الانزيمية فيها نسبة عاليه من الرطوبة واللاكتوز والفسفور وبعد ذلك عملت اختبار التذوق لجميع انواع الجبنة واظهرت النتائج ايضا فروقات معنوية عالية في الرائحة والتذوق والنكهة والرائحة والقبول العام علي التوالي .

Content

CHAPTER ONE

Introduction

Milk is a complex biological fluid, secreted from the mammary glands of all mammals, it contains major constituents include water, lactose, fats, protein, minerals, vitamins and enzymes Birch. G.*et al* (2012). These properties and composition of milk make it an ideal food for the mammalian neonate.when the supply of fresh milk is in surplus.

The producers try to make the best use of it. So milk can be separated into cream or processed into cheese, butter or yoghurt, in order to increase the keeping quality of milk and offer the consumer a product with good flavor and high nutritive value Niir . B. (2010), the process of cheese making has been adopted(Quinee, 2004).

Approximately one third of the world's milk production is used in cheese manufacture, where the manufacture of cheese is a form of milk preservation. Moreover cheese is highly nutritious food with many diverse flavors and textures, which can used as a snack or as a part of dish or prepackaged convenience food (Quine 2004) supplies abundant quantities of proteins, fat and calcium, Which are essential to good health and growth(Quinee, 2004)

The individual characteristics of each cheese variety are due to the type of milk, microbial starter culture and the manufacturing procedure used (Ahmed, 1997).

In most traditional dairy animal herds and smallholders dairy animals dominate milk production in Sudan; both systems do not have cooling facilities for preservation of raw milk during marketing. Where such facilities have been provided, either they are in adequate or in accessible to most of the farmers. Moreover, the frequent breakdowns of electricity interruptions are not uncommon. Alternative milk preservation methods are therefore required as to

convert it in in dairy products to address this problem, so the Sudanese traditional white cheese, which processed by natural fermentation induced by microorganisms either present in the raw milk or from the surrounding environment, where the starter culture processing has not been investigated (Ahmed, 1997).

Dairy starters are harmless, active bacteria grown in milk and impart certain characteristics and qualities to various milk products (kosikowsski 1977).

Various starter types are used for cheese making in the dairy industry , the lactic acid bacteria are used to induce lactic fermentation,apart so essential in the manufacture of cheese and fermented milk product(Harrigan and mac Cance,1976).

The use of starter culture in the production of cheese encourages whey separation, inhibits the growth of pathogenic bacteria generates some aroma compounds and increases the degree of ripening, though the use of starter culture is not common.

The enzymatic and acidic are the two types of coagulation allowed to produce the curd in some countries for certain types of cheese to acidify the curd by citric acid (Y. H. Hui *et al(1997)*

Therefore, the present work was conducted to reach the following objectives:

- To study the chemical composition, physical properties of cheese produced from goat's milk using enzymatic and citric acid coagulator.
- To investigate possibility of using lemon juice (citric acid) as coagulant in manufacturing of white cheeses.
- To study a consumer's evaluations of Sudanese white cheese (Gibna Beida) made from cow's milk and goat's milk using citric acid.

Chapter Two

Literature Review

2.1 Milk importance and composition:

Milk plays a major contribution to human diet in all over the world, however, it considered to be the most perishable food because, it provides an excellent culture and nutritional materials for the growth of microorganisms, beside it provide both energy and the building materials necessary for growth and also contains antibodies which protect the young mammal against infection, in addition of it's enough sufficient of the needs estimated about 1000 litres of milk for growth (Harding, 1999).

The composition of milk differs widely between species. Factors such as the type of protein; the proportion of protein, fat, and sugar; the levels of various vitamins and minerals; and the size of the butter fat globules and the strength of the curd are mainly the substances affecting with animal species (Raw Milk Cheese Makers' Association, 2009).

Hand milking is the common method and milk produced either consumed raw or processed in traditional way soon after milking. So, Ibrahim (1969) reported that in Sudan, some people depend on goat's milk which they kept at house.

Mustafa and Idris (1975) cited that in Sudan milk supply is largely depends on village herds marketed by milk venders.

2.2 Population and Importance of goats in Sudan:

According to the latest estimate of livestock in Sudan there are 32132270 heads of goats, therefore, goat production plays an important role in the

improvement of income for poor families in rural areas and is contributing positively to poverty alleviation programs ((Ministry of Animal wealth,2014).

There are distinguished four local breed types of goats scattered in different parts of the Sudan, such as Nubian and desert goats Hassan and El Derani (1990).

2.3: cow's and goat's milk constituents:

As shown in table (1) bellow, the composition of dairy milk varies between the different mammals species according to genetic factors, such as the species of mammal, individuality of the dairy animals, breed and environmental factors that include: age, stage of lactation, health of the animal, climatic conditions and herd management

Table 1.Approximate composition of milk from various species of mammals.

component / animal	Fat	Casein	Lactose	Albumin	Ash	Water
Cow	3.75	3.0	4.75	0.4	0.75	87.3
Goat	6.0	3.3	4.6	0.7	0.84	84.5
Ewe	9.0	4.6	4.7	1.1	1.0	79.6
Camel	3.0	3.5	5.5	1.7	1.5	84.8
Buffalo	6.0	3.8	4.5	0.7	0.75	85.0
Cow	3.75	3.0	4.75	0.4	0.75	87.3

Source :(Connor, 1995)

2.4 Definition of cheese:

The present word cheese is derived through the old English words (case) and (chiese) from the latin (causes).which means clotting or solid curd, where the expansion of the numbers of types of cheese makes a simple definition of cheese difficult, where it's defined as the curd of milk produced by enzyme activity and subsequent separation of the whey from the coagulum to give more solid curd (Scott.1986).

Another definition of cheese is that : it is solid curd with some or all of the whey drained off and further matured during storage, also, cheese defined as the curd that formed by the action of lactic acid bacteria, organic acids such as lemon juice or vinegar or rennet and some times in the presence of heat (Payne, 1990).

2.4.1 Definition of Sudanese white cheese:

Warsama et al (2006) reported that Sudanese white soft cheese contained47.8 % total solids,14.0 % fat,15.9 protein,6.2% ash.

Also Sudanese white cheese made with 6% salt had higher total solids,crude protein and fat content(Hamid et al 2008).

2.5 Cultures used in fermented milk :

Fermented dairy products have long been an important component of nutritional diet. Historically, fermentation process involved unpredictable and slow souring of milk caused by the organisms naturally present in milk. However, modern microbiological processes have resulted in the production of different fermented milk products of higher nutritional value under controlled conditions. These products represent an important component of functional foods, and intense research efforts are under way to develop dairy products into which probiotic organisms are incorporated to make them more valuable. This article provides an overview of the different starter cultures and health benefits

of fermented dairy products as yogurt and cheese, which can be derived by the consumers through their regular intake (Kullisaar et al., 2003).

Many researches mentioned that, milk fermented by selected culture of lactic acid bacteria (LAB) has high biochemical activity and antioxidant activity (Sinyavskiy, 2005; Villani et al., 2005). Several early studies demonstrated the ability of supplementing yogurt with fruits (Lurton and Ouattrin, 2003; Skrede *et al*., 2004; Apostolidis et al., 2006), but was less supplemented with vegetables.

2.6 Cheese yield:

According to Kosikowski (1978) the cheese yield is directly related to the final moisture content of the finished cheese, where a high moisture cheese gives high yield and a low moisture one gives low yield, while it influencing by the composition of milk, moisture content of the final cheese and the degree of recovery of the fat and casein by the curd during cheese making.

(Aleandri *et al*., 1989) found that the relationship between predicted cheese yield and curd firmness depends on the fat level, while the increasing curd firmness increases cheese yield only at the low fat level.

2.7 Cheese manufacturing:

Milk from various animals particularly cattle, buffaloes, goats and sheep is used to make cheese, whereas the cheese manufacturing is an important method of preservation of milk in dry hot countries where there is a surplus of fresh milk and where there are no other suitable methods of milk preservation, where the basic procedure is very simple and is based on the spontaneous processes which, thousand years ago, probably led the development of cheese (Mocquot and Bejambes 1960; Ibrahim, 1970).

Rudimentary farm production methods have been replaced by modern manufacturing plants no single methods exists for any specific variety as names and making procedure vary from country to country (Carlos and Sequeira, 1981).

2.8 Cheese manufacturing from cow:

As declared by (Carlos and Sequeira, 1981), the cheese making survived as an art form for more than 7000 years the advance of scientific knowledge has led to a better understanding of the raw material, milk, and the cheese making and ripening processes, while the number of developments have taken place which aids the cheese makers to produce a better and more consistent quality cheese.

These developments include the findings of Pasteurization in 1857 that bacteria harmful to the cheese process as well as pathogenic microorganisms could be destroyed by heat; the introduction of pure cultures of microorganisms (starters cultures) to produce acid at a reliable and consistent rate; the refinement of the extraction of rennet from calves resulting in better quality cheese curd and the development of objective methods, for the assessment of curd and cheese quality.

Therefore, the cheese maker who had relied on the art of the process now has a better knowledge and better facilities to guide the process according to the cheese making recipe.

A cheese making recipe is a guide for the manufacture of a specific variety of cheese and contains steps which, when followed, will result in a cheese of good quality. Due to variations in the chemical and microbiological quality of milk and cheese making ingredients such as starter, rennet and salt it is not always possible to produce the best quality cheese. This is particularly true of cheese making at farm level where facilities similar to those at factory or large-scale manufacture do not exist. However, the experienced cheese maker is able to

control the process and modify the recipe to limit the harmful effects of less than good quality ingredients. The importance of good quality milk and cheese making ingredients to produce good quality cheese cannot be over-emphasized ingredients for cheese making

There are a number of ingredients which are essential for cheese making but some ingredients, e.g. coloring, added chemicals etc. are not required for all varieties of cheese.

Good quality milk from the cow, sheep, goat etc. is required. However, knowledge of its chemical composition and bacteriological quality is desirable if cheese of consistent quality is to be made.

The recipe and the market will determine if coloring matter should be used. Occasionally it is required to bleach the original colour of the milk and to whiten the curd.

Chemicals such as calcium chloride and sodium nitrate are recommended in recipes for some varieties of cheese to improve curd quality and prevent the growth of organisms which may cause problems during the ripening or maturing of the cheese,

Rennet is the usual coagulant used but the juice extract of some fruits and plants, e.g. lemons and *Calotropisprocera* may be used for some cheese varieties.

Salt (sodium chloride) may be added to some varieties of cheese, the quantity and method of addition depending on the recipe. Salt may be added directly to the milk or curd pieces; it may be rubbed into the finished cheese or the cheese may be immersed in a brine solution.

2.9. The steps of cheese making

The below listed steps in cheese making are not used for all cheese varieties and such steps as may be used will be determined by the recipe as mentioned by (Carlos and Sequeira, 1981):-

2.9.1. Milk treatment:

Milk may be heat treated, e.g. 73 C^o for 15 seconds, to destroy pathogenic bacteria and reduce microbial loads the milk may be standardized, i.e. the fat content may be increased or reduced or the casein-to-fat ratio may be adjusted.

2.9.2 .Coagulation:

Various coagulants are used, e.g. rennet and lemon juice. The coagulants bring about, under defined conditions of temperature, quantity and time, the coagulation of the milk into a firm jelly-like mass.

2.9.3 Cutting the coagulum:

The coagulum may be cut with knives into curd particles of a defined size, e.g. 1–2 cm, or it may be ladled into containers or cheese moulds. The cutting or ladling of the coagulum is a very important step in the manufacture of some cheese varieties as it determines the rate of acid development and the body (firmness) and texture of the cheese

2.10.4Heating or cooking the curd:

Heating (40–45oC) the curds and whey affects the rate at which whey is expelled from the curd particles and the growth of the starter microorganisms. For some cheese hot water may be added to the curds and whey. During heating the curds and whey may be stirred to maintain the curd in the form of separate particles.

2.9.5 Whey removal.

After heating and stirring and when the curd particles have firmed and the correct acid development have taken place the whey is removed allowing the curd particles to mat together.

2.9.6 Curd texturing.

It is a characteristic of some cheese varieties that the curd mass is allowed to develop a texture along with further whey drainage and acidity development.

2.9.10 Milling the curd.

When the curd has reached the desired texture it is broken up into small pieces to enable it to be salted evenly. Milling the curd can be done either by hand or mechanically.

2.10 Factors affecting chemical composition, yield and quality of white cheese:

2.13.1 Milk composition

Chemically, milk is a complex mixture of fats, proteins, lactose, minerals, vitamins,and other miscellaneous constituents dispersed in water phase (Bath et al., 1978).The composition of milk which is influenced by the breed of cows, season,stage of lactation,disease and genetics,affects the yield quality and functional characteristics of cheese (Quinee,2004)

(Watt and Merill, 1963) found that an average gross composition of cows' milk would be as follows:-

Water 87%30.fat 3.6%lactose4.9%protein3.5% ash(minerals) 0.7%the salts of milk are considered to be the chlorides,phosphates,and citrates of potassium,sodium and magnesium(Verma and Sommer,1957)

The chemical composition of milk affect the nature of the final cheese, where milk fat plays an important role in the development of texture, the reduced fat

cheese being firmer and more elastic than those with high fat content (Johnson,1988).

The fat content of milk is important in determining the characteristics of different cheese varieties(Alan and Jane,1994) and major proteins of milk are casein group of phosphor protein having a molecular weight in the range of 20 000 to 30 000.

The principal caseins are known as α-casein, β-casein and Kappa casein and are found in fresh milk in the proportion 3:2:1 respectively, with over 90% in micellar phase (Mchenzie,1971).

The primary function of casein is to provide amino acid for the calf, other functions have been noted e.g. K-casein stabilizes the casein micelles: otherwise curds would form in the milk β - lactoglobulin provides the characteristic of cooked flavor to heated milk.When this protein is denatured by heat it will prevent curd formation which is necessary in the manufacture of cottage cheese (Bath *et al*, 1978).

2.13.2 Sodium chloride(Nacl)

It is normally added as solid or in solution according to the procedure used in the industry, where the salt in cheese serves: as a preservative, contributes directly to flavor and provides sodium.

In addition to these functions of salt level has a major effect on cheese composition, microbial growth, enzymatic activates, biochemical changes and hence overall quality.

The salt content of cheese differs markedly with variety,ranging form about 0.5-0.7%(w/w) in acid curd varieties such as cottage cheese, to about4-6%(w/w) in pickled cheese such as Domiati and feta(Quinee,2004) .

However, Gibna Beyda and Domiati cheeses are characterized by a unique method of salting in which salt is added to milk prior to renneting. A level of 5-15% salt is generally added to milk.The unique practice was originated due to the poor quality of milk supply and thus the salt was added as a preservative against pathogenic organisms and to control starter activity (Abdalla, 1992; Khateeb, 1997). In addition, the proper salt concentration controls the fermentation, inhibits some spoilage and hazardous microorganisms and provides a selective environment for desirable micro organisms ,1973) used low initial salt level and fheurtr added salt to the pickling whey.
(Ramet and El Mayda, 1980) reported that high sodium concentration inhibited curd formation and decreased the curd strength, and when sodium chloride was added to milk at 3% rennet coagulation was reduced by 9% but when the concentration was increased, the coagulation strength decreased.
(Khalid,1991) reported that the yield of fresh cheese was 22.9% and 23.8% from milk salted with 6% and 8% respectively.Total solids,protein, fat,moisture content and acidity of white soft cheese was 38.19% 15.0%,61.8% and 1.2,respectively for cheese made from 6% salted milk Ahmed(1998) found that raw milk cheese with6% sodium chloride gave the highest total solids content(48.35_+1.11%) in comparison with that of cheese with 4% sodium chloride (44.04+4.39%) and 2% sodium chloride (43.71_+3.51%).
(Abdel Razig, 1996) reported that the yield of fresh cow's milk with2% sodium chloride was 19.08 and the chemical composition was 23.4%, 15.3%,44.59% and 2.21% for fat,protein,total solids and ash content,respectively.

2.13.3 Calcium chloride ($Ca\ Cl_2$)

Calcium chloride plays a role in the milk coagulation and gelation
The legal limit in the cheese is 0.02 %(w/w) in milk (Farke, 2004). In addition calcium reduces the rennet coagulation time by neutralizing the negatively charged

residues the on casein, which increase the aggregation of rennet micelles .Addititttion of low concentration of calcium also increases gel firmness.

Both phosphorus and the proportion of undissolved milk salts have important effect on cheese texture (Lucy and fox, 1993).

(Denkov, 1973) recommended the addition of 20-30 gm. calcium chloride per 100 liter of cow's milk or 10-20 gm per 100 liter of ewe's milk to obtain the optimum curd firmness in 20-50 min , and to reduce losses of fat and solids-non fat in whey . Less calcium chloride will produce a smooth curd and therefore about 0.02% $CaCl_2$ needed for satisfactory coagulation.

(Scott,1986) reported that when using highly heated milks, and retention of too much calcium chloride apart from producing a hard unyielding curd, produces cheese with bitter flavor and harsh body .

(Pozar *et al*., 1970) illustrated that in general, milk clotting activity of enzyme preparations can be improved by addition of $CaCl_2$. Increased correlation was found between calcium content of milk and calcium sensitivity of enzymes, with the higher sensitivity appearing at lower calcium content.

2.14 **coagulants types of cheese :**

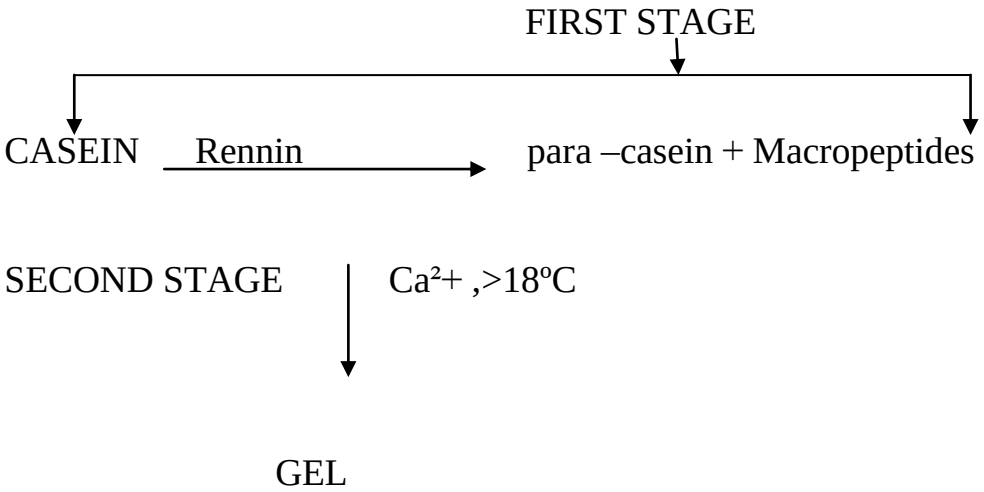
2.14.1 Enzymatic (rennet) coagulation:

Caseins(~ 80% of milk protein) occur in milk in the form of large,multi-molecular aggregates called micelles. Casein micelles are approximately spherical aggregates of the 4 types of casein ,alpha s2-,beta-and kappa-casein,together with inorganic ions collectively referred to as colloidal calcium phosphate.there is an uneven distribution of the different caseins throughout the micelle .In the particular kappa-Casein stabilizes the the micelle and prevents them from aggregating together in the presence of Ca2+. Were is not for, kappa-casein the other casins would aggregate together as they are highly phosphorylated.

Kappa-Casein is divided into 2parts.Residues 1-105 (approx .two- thirds of the molecule) are hydrophobic and assoeciat with the other caseins. The C-terminal region of kappa-casein(residues 106-169, approximately one-third of the molecule)are hydrophilic (usually containing complex sugar groups esterified to The residues)and protrude into the environment ,stabilizing the micelle due to steric reasons and the reduction of its zeta-potential.

Enzymatic coagulation of milk involves modification of the casein micelles via limited proteolysis of Kappa-casein by proteinase preparations ("rennets")

Followed by Ca2+- induced aggregation of the rennet micelles.



Kappa-Casein is the only casein hydrolyzed during rennet coagulation. Kappa-Casein

Is hydrolyzed at its phe 105-Met106) bond to produce para - Kappa-Casein(Kappa-Casein fragment 1-105, Kappa-CN f1-105) and macropeptides(also called glycomacropeptides or caseinomacropeptides, , Kappa-CN f1-106-169) .

Macropeptides diffuse into the aqueous phase,para-kappa remains attached to the micelle core .Macropeptides(~30% kappa-casein or 4-5% total casein)are lost .This is an unavoidable loss and a consequence of rennet coagulations but it does have consequences for cheese yield .Proteolysis of kappa-casein by the proteinase (s) in rennet preparations is referred to as the first stage of rennet action .

Removal of the macropeptides from micelles reduces zeta(surface)potential of the micelles from -20 to about -10 m V and removes the steric stabilizing layer. When about 85% of total kappa-casein is hydrolyzed, colloidal stability of the micelles is reduced so much that they coagulate at temperatures above about 20º C in the presence of Ca+ .This event is called the second stage of rennet action Fox,(P.F and P.L.HSweeney(1998).

Similar jelly can control the degree hardness of freshness required degree coagulum rubber and soft and homogeneous can be cut into a coherent (Knit) hraih Knife without cracking or breaking up of coagulum and coagulation in the range of 20 minutes,Chinthu Udayarajan (2007).

2.14.2 Acid coagulation :

This process,the PH of the milk drops to the acidic range(PH<4.6).This alters the interaction of the calcium phosphate molecules with the micelles,and they begin to leak out of the globs.Once this happens,the micelles become destabilized and begin to interact with eash other,forming agel matrix .The source of the acid can be exogenous (directly adding acid such as citric acid

or vinegar to the milk)or endogenous (from the lactic acid produced by bacteria Melissa Looney(2010).

2.15 Characteristics of gibna- beida (white soft cheese)

Ibrahim (1971) found the average cheese to have 44.3% water,4.3% salt , pH value of 4.6 and whey titrable acidity (as lactic acid) of 2.3% so he categororized Gibna-Beida as falling between the medium and high moisture cheese of the world.

Ali (1987) analyzed six samples of gibna-beida and found the following mean values: moisture content 56.6%, Protein 13.8% , fat 14.0% , salt 7.9% , titrable acidity (as lactic acid) about 1.0% and pH value of 4.9. Judging by the moisture content range of 55.59%, so that he categorized gibna-beida as a soft cheese, and according to its salt contents, he grouped it with the egyption dominate cheese and the Greek feta cheese.

Allagabo (1986) analyzed 24 samples of white cheese and found the following average values for its components: moisture 61.2%, protein22.2%, fat 12.8% , salt 4.2% , and pH value of 4.0 . she stated that the composition of gibna-beida was similar to that of the domiati cheese of Egypt, which given by el –shibiny et al (1973) is as follows: moisture24.6-56.45, salt 5.8-6.1%acidity (as lactic acid) 0.2-0.8%, fat 24.2-28.7%, salt 5.8-6.1% acidity (as lactic acid)0.2-0.8% and a pH of 4.2-6.0.

Carlos and sequeira (1981) analyzed fresh white cheese and reported that the chemical composition of fresh white cheese was 47.51% moisture content, 5.03% ash , 0.78% Nacl, 22.78%fat , 20.75% protein , 0.39% lactose.

2.16 Microbial quality of white soft cheese :

The material for good quality cheese is good quality, clean, good tasting milk that is low in somatic cell count, free antibiotic and has a relatively low microbial count (farkye , 2004).

Ibrahim (1973) studied the microbiological quality of vender's milk offered for sale on the market. The average plate count was 78x10 bacteria per ml for cow milk.

Mustafa and idris (1975) reported the total count of more then one million bacteria per ml, coliform count form 3x10 to more than 3x10 per ml. Ibrahim (1971) found that yeasts made the primary microbial group of gibna- beida collected form Khartoum market, with counts ranging form 100 to 100.000 cell .

Allagabo (1986) found that standard plate count of yeast was 4x10 per gram . Average yeast and mould count of 2.9x10 per gram and salt tolerant bacteria 2x10 per gram were found in gibna .

Ahmed (1985) and allagabo (1986) showed that during storage of white cheese for a period of four months at 37^{o}C, all microbial groups , including lactic acid bacteria , yeasts , and mould ,s and viable count increased . the average yeast count of market cheese was higher than that of the lactic bacteria. They found , however, in storage experiments, that the lactic acid bacteria. Count increased faster than the yeast count, reaching much higher values.

The process of using acid in coagulation drops the pH of the milk to the acidic range (pH < 4.6). This alters the interaction of the calcium phosphate molecules with the micelles, and they begin to leak out of the globs. Once this happens, the micelles become destabilized and begin to interact with each other, forming a gel matrix. The source of the acid can be exogenous (directly adding acid such as citric acid or vinegar to the milk) or endogenous (from the lactic acid produced by bacteria) Melissa Looney(2010).

Chapter Three

Material and Method

3.1 Materials:

3.1.1 Milk source:

Fresh cow and goats' milk was obtained from experimental dairy farms of animal production college (Kuku) and college of Agricultural studies (Shambat) that belong to Sudan University of science and Technology, during the period of September to November (2014).

3.1.2 Rennet:

Rennet (Hunseuswp) of specification (HR. HANSEN coagulant stick 50/ Itr. of milk) was purchased from veterinary pharmacy.

3.1.3 Salt:

Commercial salt (Nacl) was purchased from local market.

3.2.4 Calcium chloride($CaCl_2$):

$CaCl_2$ used in this study was brought from chemical laboratory department of animal production, College of Agricultural Studies, of science and technology.

3.2 Equipments:

The following equipment was used to achieve this research work:

- Milk can.
- Stainless steel spoon.
- Stainless knives.
- Cheese molds.
- Cheese cloth.
- .,water buth,
- sensitive balance .

3.3 Methods: (cheese manufacture)

Twenty liters of cows and goats' raw milk was transmitted to the laboratory of Animal Production Department (College of Agricultural Studies).in pasteurized at (85 C^o for 30 minutes), then, the milk was immediately cooled to 40 C^o and 180 gm. (w/w) of sodium chloride were added to the whole milk followed by adding of rennet (0.1dissolved in water). Then it incubated for 60 Minutes for coagulation to occur (Rennet coagulation). The two batches of (Acid coagulation) also pasteurized at (85 C^o for 30 minutes), then lemon juice was added and then the mixture was stirred until it started clotting (after ten Minutes of acid addition). Thereafter, salt was added (180 gram of sodium chloride).

Later, the milk mixture was divided into four batches (each5liter); cow's milk was treated with enzyme (Rennet coagulation), and acid (lemon juice). Likewise, goat's milk was treated with enzymatic and acid coagulations.

3.4 Chemical Analysis :

3.4.1 Fat content:

The fat content was determined by Gerber method according Bradly *et al*. (1992) as follows:

In a clean dry Gerber tube, 10 ml of sulphuric acid (density1.815 gm/ml at 20 C were poured, then 10.9 ml of milk sample were added Amyl alcohol (1-2 ml) was added to the tube , followed by the amount distilled water. The contents were thoroughly mixed till no white particles could be seen .the Gerber tube were centrifuged at 1100 revolutions per minute (rpm)for 4-5 min . the fat column was then read immediately.

3.4.2 Protein content:

The protein content was determined by kjeldahl method according to AOAC (1990) as follows:

3.4.3 Digestion: ten milliliters of milk were weighed and poured in dry kjeldahl flask and 2 gm of $CuSO_4$ were added. Concentrated sulphuric acid (25 ml)was added to flask .the flask were heated until a clear solution was obtained (2-3 hrs) and left for another 30 min. the flask were removed and allowed to cool.

Distillation: the digested sample was poured in a volumetric, flask and diluted to 100 ml with distilled water .five milliliters were distilled using 10 ml of 40% NAOH. The distillate was received in a conical flask (100 ml) containing 25 ml of 2% boric acid plus 3 drops of indicator (bromocresol green + phenolphthalein red) the distillation was continued until the volume in the flask was 75 ml, then the flask was removed from the distillatory.

The concentration of hydrogen ions(in moles)required to reach the end –point is

3.4.7 Total solids (T S)

The Total solids content was determined according to the modified method of AOAC (1990) in which three grams of the sample were weighed into a dry clean flat –bottomed aluminum dish, and heated on steam bath for 10-15 min. The dish was placed in an oven at $105C^{o}$ overnight, then cooled in the desiccator and weighed quickly. Weighting was repeated until the difference between the two successive reading was <0.1 mg after that, the total solids content was calculated from the following equation:

$$T.S\ (\%)\ \frac{w_1}{w_0} \times 100$$

Where: w_1 = weight of sample after drying

W_0 = weight of sample before drying

3.4.8 solids –non- fat content:

Solids-not- fat content was determined directly from the following equation:

SNF (%) = TS% - % fat

3.4.9 Ash Content:

The ash content was determined according to (AOAC, 1990). Five grams of the sample were weighed into a suitable crucible and evaporated to dryness on steam bath, then placed in a muffle furnace 550 C^o until ash is carbon free (2-3 hrs) then the residues cooled in a desiccator and weighted. The ash content was calculated from the following equation:

Ash (%) $\frac{w_1}{w_0} \times 100$

Where: w_1 = weight of ash

W_0 = weight of sample

4 pH and Titeratable Acidity

Milk pH was measured by using digital pH meter according to AOAC (1990).

3.4.12Titeratable acidity :

Tirataleaciditiy was determined according to (AOAC, 1990). Ten grams of minced cheese or 10 ml of milk were placed in a 200 ml conical flask, followed by addition of distilled water at 40^{o}C until the volume in the flask was 105 ml. The samples were then vigorously agitated and filtered through filter paper (whatt man no 41). 25 ml filtrated and were pipetted into conical flash and 5 drops of phenolphthalein indicator were added.

The sample was titrated against 0.1 N NaOH till a faint pink colour that lasted for at least 30 second was developed.

The acidity of cheese was calculated as follows:

$$\text{Titeratable acidity (\% lactic acid)} = \frac{Tx4}{W}$$

Where :

T= titration figure

W=weight of sample

3.4.13 Fat content:

Fat content was determined by Gerber method according to AOAC (1990) as follows three geber tubes each received 10ml of sulfuric acid (density 1.815 gm /ml at 20^{o}C).

Then 10.94 ml of milk sample were added to one tube .the other yube received 3 g of minced cheese sample. One milliter of amyle alcohol and distilled water at 20 ^{0}C were added .the tubes were thoroughly mixed till no white particles were seen. Centrifuged at 1100 revolutions per minute (rpm) and then directly read on the tube .

3.4.14 Total solids content

Total solids content was determined according to the modified method of AOAC (1990) .two grams of cheese sample or 3 ml of milk were placed in a clean dried flat bottomed aluminum dish .the weights of sample and dish were placed in a clean dried flat bottomed aluminum dish. The weights of sample and dish were recorded and the dishes were heated on steam bath for 15 minutes. The dishes were dried in an air oven at 100^{o}C for 3 hrs, after which they were transferred to desiccators to dry and then weighed. Heating .cooling and weighing were repeated several times until

the difference between successive weighings was less than 0.5mg. the total solids content was calculated according to the following equation :

$$\text{Total solids (\%)} = \frac{wl \times 1000}{Wo}$$

Where:

Wi= weght of sample after drying

Wo= weight of the original sample

3.4.15 Protein content

The protein content was determined by kjeldahl method as described by AOAC, (1990) .three grams of cheese or 10 ml of milk were placed in a kjeldahl flask then two kjeldahl tablets 1 gm Na2 So 4 and equivalent of 0.1 gm Hg were added .twenty-five milliliters of concentrated sulfuric acid (density of 1.861 ml at 20^{o}C) were added to the flask. The mixture was then digested on a heater until a clean solution was obtained (3hrs) and the flasks were removed and left to cool.

The digested sample was poured in 100-ml volumetric flask , and diluted to 100 ml with distilled water . five milliliters from each sample were taken and neutralized with 10 ml of 40% na OH . the distillate was received in a conical flask containing 25 ml of 2% boric acid plus 3 drops of indicator (boromcerol green plus methyl red) . the distillation was continued until the volume in the flask was 75 ml . the flask was then removed form the distillatory . the distillate was then titrated a gainst 0.1 N HCL . until the end point was reached (red color). The protein content content was calculated as follows :

$$\text{Nitrogen \%} = \frac{T \times 0.1 \times 0.014 \times 20 \times 100}{\text{Weight of sample}}$$

Protein (%) = nitrogen (%) x6.38

Where:

T = titration figre

0.1=normality of HCL

0.014= atomic weight of nitrogen /1000

20= dilution factor

6.38= conversion factor of milk nitrogen into protein

3.4.16 Moisture content

Moisture content of cheese was determined by the method described y ling (1963) as follows:

Three grams of minced cheese sample or 3 ml of milk were weighed into a clean dry aluminum dish of a known weight. the disk was uncoverd, placed on a boiling water bath for half an hour, then the dish was placed in a well ventilated oven at 100^{o}C for 3 hr. the lid was placed and the dishes were transferred to a desiccators to cool for about half an hour and weighed the heating and weighing were repeated until a constant weight was obtained . The moisture content was calculated as follows:

$$\text{Moisture content} = \frac{a1\text{-}w2 \times 100}{Wl}$$

Where :

W1= weight of sample before drying

W2= weight of sample after drying

The method is as follows as described by (AOAC,1990).

With an accurate 2cc. piptte trans 2cc. Of milk to a100cc. Volumetric flask previously

Half filled with saturated picric acid solution shake,and filter. Transfer 5cc.of the filtrate to alarge te_tube or 100cc.Volumetric flask,add 15cc. Of saturated picric acid solution and 3cc.Of 20 per cent sodium carbonate solution.Mix and place in aboiling water bath for 15 minutes.Cool and dilute to avolume of 100cc.The standard consists of a solution of lactose in saturated picric acid solution. For use with cow milk this solution should contain 5 mg

Of lactose in 20 cc. For use with human milk it is necessary to employ two standards,

Namely,one containing 5 and the other containing 7 mg.

Of lactose in 20 cc.To 20 cc. Of the standard add 3 cc. Of the sodium carbonate solution and heat simultaneously with the milk filtrate. Cool,dilute to 100 cc,and compare the colors

In the usual manner in a suitable calorimeter.

3.5 The yield of manufactured cheese:

The final product of the white cheese from the four treatments was weighted after three days of manufacturing and the yield of every replicate recorded by using sensitive balance, and means of treatments calculated to compare the different yield of every treatment.

The different cheese manufactured from cow and goat's milk using enzyme and acid co- aggulation were weighted after three days of drying, using sensitive balance and then the obtained weight was recorded.

3.6 Panel taste evaluation:

Ten postgraduate students were randomly selected for sensory and cheese quality evaluation (color, flavor, smell; texture and overall acceptability).

The form in which the panelists have evaluated scored cheese were shown in the appendix (1).

3.7 Statistical analysis:

Data were analyzed using completely randomized design (CRD), whereas, mean separation was performed using Duncan multiple range test (DMR) as described by (Little and Hills, 1978).

3.8 Calcium and Phosphorus:

The value of goat's milk Calcium found in this study was 120mg/100 ml, which is considered lower than that estimated by (Aisha ,2009) 116 mg and higher than that reported by Elamin and (Wilcox,1992) 30 mg, the difference might be due to seasons.

The mean cows' milk phosphorus in this study in was (88mg/100ml) which is higher than that reported by (Aishs, 2009) 24m g and also than that reported by (Gorban and Izzeldin, 1997) 76m

acidic goat's milk cheese recorded higher protein, fat, ash, T.S, ph., TNF, percentages, while acidic cow's cheese showed high moisture, lactose, Ca and acidity.where, enzymatic goat's cheese revealed high percentage, of protein, fat, ash, T.S, Ca and acidity, but enzymatic cow's cheese revealed high moisture, lactose, ph., TNF and Phosphorus.

Chapter Four

Results and Discussion

4.1 The Physiochemical Composition of goat milk compared with The Cow Milk:

The results relevant to physiochemical composition of both goats and cows' milk are shown in table (4.1). The results revealed high significant differences ($p \leq 0.05$) in physiochemical characteristics that include) moisture, protein, fat, total soil TS, acidity, ash, lactose and SNF. However, Calcium and phosphorus contents for the two milks secured insignificant ($p \geq 0.05$) differences, table (4-1). It was found that protein and SNF in goats' milk (3.500 ±0.329, 9.200 ±0. 521)were significantly higher than that found in cows' milk (3.300 ±0.329, 9.080±0.521s

4.2 Chemical and physical analysis of goat's milk

4.2.2 Chemical analysis

4.2.3 Moisture content

In the present study; average cows' milk moisture content found to be (87.25 % ± 0.670), this value was lower than that reported by (Ashia, 2009), who reported (88.7%), and (Rehab, 2013), who recorded (87.7 %). However, our finding is in the range with the moisture's value (84 to 90 %.) reported by (Mahamoud, 2009), furthermore, the difference can be attributed to seasonal variations and availability of drinking water.

4.2.4 Protein % :

The average of protein content in reported in this study is (3.4%) which is similar to that found by (Wilson, 1984) also he recorded a (3.4%) for protein. But, the present protein value is higher than that reported by (Byoumi, 1990) who found it (3.3%)

4.2.4 Fat %:

The average of Fat content, in this study was3.4 % it's lower than that estimated by (Ashia, 2009) 3.7%

4.2.5 Lactose content:

The average of Lactose in the present study was 4.85 % its higher than that estimated by Ashia (2009) 3.28% and similar to that reported by Elamin and Wilcox (1992) 4.2%. Byoumi (1990) estimated it as 5.5%, the difference may be due to the stage of lactation period, as it was noticed that, lactose % increased gradually at parturition until it reached 5.58% at the tenth day (Abu-Lehia 1989). Generally lactose content of goat milk varies greatly and usually, depending on feeding and watering conditions (Yagil and Etzion, 1980; Yagil, 1994).

4.2.6 Total solids

The average of Total solids in the present study estimated 12.750 % which is higher than that reported by (Ashia, 2009) 11.3%; in general the total solids tend to decrease in hot season, as in summer.

4.2.7 Ash content:

The average of Ash content was 0.84 % which higher than that reported by (Rehab, 2013) 0.73%, and it is lower than that reported by (Elamin and Wilcox, 1992) 0.80%, looses a considerable amount of its water to milk for the nourishment of young calves.

4.2.8 Calcium and Phosphorus:

The value of goat's milk Calcium found in this study was 120mg/100 ml, which is considered lower than that estimated by (Aisha ,2009) 116 mg and higher than that reported by Elamin and (Wilcox,1992) 30 mg, the difference might be due to seasons.

The mean cows' milk phosphorus in this study in was (88mg/100ml) which is higher than that reported by (Aishs, 2009) 24m g and also than that reported by (Gorban and Izzeldin, 1997) 76m

acidic goat's milk cheese recorded higher protein, fat, ash, T.S, ph., TNF, percentages, while acidic cow's cheese showed high moisture, lactose, Ca and acidity.where, enzymatic goat's cheese revealed high percentage, of protein, fat, ash, T.S, Ca and acidity, but enzymatic cow's cheese revealed high moisture, lactose, ph., TNF and Phosphorus.

Table (1): Physiochemical Analysis of Cows and goats' milk.

Parameters	Treatments (Mean ± SE)	
	Cow's Milk	**Goat's Milk**
Moisture	87.720[a] ± 0.670	87.250[a]± 0.670
Fat	3.20± 0.115	3.400± 0.115
Protein	3.300[a]± 0.329	3.400[b]± 0.329
Ash	0.790± 0.306	0.840±0.306
Lactose	4.990[a]± 0.163	4.580 [a]± 0.163
T.S	12.280 [a]± 0.618	12.750 [a] ± 0.618
S.N.F	9.080 [a]± 0.521	9.200 [b]± 0.521
pH	6.660 [a] ±0.231	6.350 [a] ± 0.231
Acidity	0.180[a] ±0. 029	0.170 [a] ±0.029
Calcium	117.000±7.627	120.000±7.627
Phosphorus	85.000 ±4.082	88.000±4.082

Mean in the same column not followed by the same common letter(s) differ significantly at ($P < 0.05$).

4.2.9 The acidity

The acidity percent obtained in recent work was (0.17%), this figure is lower than that reported by (Aisha, 2009) she found (0.18%), and also lower than that reported by (Karim and Gook Lani, 1987) 0.2%, which is considered the optimum acidity readings.

4.2.10 The pH

pH value of goat's milk in the present study is (6.35), it is similar to that reported by (Mahmud, 2009) (pH6.34) and lower than that reported by (Rehab, 2013), (6.40).The differences may be due analytical procedure used.

4.3 Physiochemical characteristics of cheese of cows and goats' milk

The data pertinent to physiochemical characteristics of goat's and cow's milk cheese is presented in Table (4.2.). The statistical analysis revealed significant ($p \leq 0.05$) differences among cheese physiochemical characteristics for the two species.

It was noticed that acidic cheese that prepared from goat's milk had higher contents of protein, fat, ash, T.S, TNF and phosphorus.

While acidic cheese from Cow's milk; showed high moisture, lactose, Ca and acidity.

Moreover, enzymatic goats' milk cheese secured high percentage, of protein, fat, ash, T.S, Ca and acidity. Whereas, cow's milk cheese which coagulated by enzyme revealed high percentage, of moisture, lactose, ph., TNF and Phosphorus.

Table (2): Physiochemical Analysis of Cow and Goat Cheese:

Parameters	A Cow cheese enzymatic coagulation	B Cow cheese acidic coagulation	C Goat cheese enzymatic coagulation	D Goat cheese Acid acidic coagulation
Moisture (%)	61.900[a]±0.670	65.100±0.670	61.333[c]±0.387	66.933. ±387
Protein (%)	13.800[c]±0.329	12.100 ±0.329	14.033[b]±0.190	12.433 [d]±.0190
Fat (%)	14.900 [bc]±0.115	14.600 ±0.329	15.767 [b]±0.067	15.167 ±0067
Ash (%)	4.300 [ab]±0.306	3.300 [c]±0305	4.633[c]±0.176	4.267 [a]±0.176
Lactose (%)	5.100 [d]±0.163	4.9007±0.163	4.367 [ab]±0.094	4.200 [c]±0.094
T.S (%)	38.100 [d]±0.618	34.900±0.618	38.800±0.357	36.067 [d]±0.357
S.N.F (%	23.200[c]±0.521	20.300±0.521	23.033±0.301	20.900 [c]±0.301
Ph	5.600 [c]±0.231	5.500 ±0.231	5.567 ±0.13 3	5.667 [d]±0.133
Acidity As lactic acid (%)	0.730[b]±0.29	0.750[c]±0.029	0.753[cd]±0.017	0.740[a]±0.17
Ca^{++}(mg/100g)	117.000 [c]±7.627	129.00±7.627	122.000±4.403	124.33 ±4.403
P (mg/100g)	106.000[d]±4.082	99.00±4.082	106.667±2.357	100.00[d]±2.357

Mean in the same column not followed by the same common letter(s) differ significantly at ($P < 0.05$).

4.4 Chemical analysis of cheese:

In this study, the average moisture of goat's enzymatic cheese is (61.33 %), this figure is similar to that demonstrated by (Allahgabo, 1986) he also found (61.33%) for the moisture of cheese processed from goats' milk.

The average protein (14.33%) obtained in this study is higher than that found by (Adorkour, 1992) 12.36% but, similar to that reported by (Abdel Razig, 1996). The fat percent in the recent study is also significantly ($p \leq 0.05$) higher (15.67. %) than that found by (Allah_Gabo, 1986), who reported a fat content of 12.65%.

The lactose percent (4.36 %) attained in our study is lower than that reported by (Price, Weston, 2008) 4.8% as well lower than that estimated by (Mortada et al, 2013) 6.9%.

The total solid calculated in the present work is 36.67% however, it is slightly lower than that reported by (Ibrahim, 1999) 36.75%, and also, lower than that reported by (Mortada *et al*, 2013) 33.77%.

4.5. Effect of type of milk and coagulation agents on sensory evaluation of Cheese:

Table (4.5) illustrates the sensory evaluation of cow's and goat's cheese of enzymatic and acidic coagulation.

The statistical analysis revealed significant ($p \leq 0.05$) effect on all cheese sensory characteristics (taste, flavor, smell, texture, color and overall acceptability).

Table (3): effect of milk types and coagulants on Sensory Evaluation of manufactured cheese

	Treatments Mean ± S.E				
Parameters	cow's cheese (Enzymatic)	cow's cheese (Acidic)	Goats' cheese (Enzymatic)	Goats' cheese (Acidic)	Grant mean
Smell	7.70± 0.70	7.30± 0.75	6.50 ± 0.79	6.90± 0.64	7.10± 0.35
Color	7.90± 0.59	7.60± 0.65	8.80± 0.57	7.20± 0.49	7.88± 0.29
Flavor	6.90± 0.66	7.40± 0.67	7.20± 0.68	6.50± 0.83	7.00± 0.35
Taste	7.10± 0.67	7.50± 0.64	7.80± 0.63	6.30± 0.58	7.18± 0.32
Hardness	8.10± 0.71	8.50± 0.45	7.50± 0.62	5.60± 0.60	7.43± 0.34
Texture	8.20± 0.51	7.90± 0.59	7.90± 0.60	5.80± 0.55	7.45± 0.31
Over all acceptability	8.20± 0.44	8.00± 0.56	8.10± 0.46	6.40± 0.54	7.68± 0.27

Mean in the same column not followed by the same common letter(s) differ significantly at ($p \leq 0.05$).

The evaluation of panelists disclosed that best value for the taste, color and overall acceptability were obtained from enzymatic (rennet) goat's cheese followed by enzymatic (rennet) cow's cheese, then acidic (citric) cow's cheese and the last one was acidic (citric) goat's cheese treatment.

Whereas, the best preferences for hardness and texture were obtained respectively, from enzymatic (rennet) cow's cheese, acidic (citric) cow's cheese, enzymatic (rennet) goat's cheese and acidic (citric) goat's cheese. However, the best values of smell were attained from enzymatic (rennet) cow's cheese, acidic (citric) cow's cheese, acidic (citric) goat's cheese and enzymatic (rennet) goat's cheese respectively, while the best flavor was recorded by the cheese manufactured from acidic (citric) cow's cheese, then enzymatic (rennet) goat's cheese followed by enzymatic (rennet) cow's cheese and acidic (citric) goat's cheese respectively.

4.6. The final weight of Different Cheese

Data in table (4.6) shows the effect of milk source and co-aggulation type on cheese weight, it was found that the white cheese obtained from cow's milk that coagulated with rennet enzyme (RCH) exerted lower total weight than the that obtained from the same milk using Lemmon juice (citric acid coagulant), while the cheese obtained from goat's milk using rennet enzyme coagulant (RCH) was recorded lower total weight than the that obtained from the same milk using Lemmon juice (citric acid coagulant), where the values of weight of the final Sudanese cheese (Gibna baida) obtained for the two treatments of cow's and goat's white cheese using rennet and acid coagulant were (0.640 kg, 0.735kg, 0.720kg and 0.785kg respectively.

The final findings revealed that the weight of the final products obtained from cow's and goat's milk using citric acid coagulant were higher than that attained from the same milk using rennet enzyme coagulant.

Table (4) the effect of milk source and co-aggulation type on cheese weight

Parameter	Treatments			
	Rennet cow's cheese	Citric cow's cheese	Rennet goat's cheese	Citric goat's cheese
Cheese weight (kg)	0.640^{a}	0.735^{b}	0.720^{b}	0.785^{c}

Mean in the same column not followed by the same common letter(s) differ significantly at ($P < 0.05$).

Appendix

Sudan University of Science and Technology

College of agricultural studies

Panel Taste form production of camel milk yoghurt supplemented with cow milk

Name …… age ……

Sample code	Taste	Color	Flavor	Smell	Texture	Over all Acceptability
A						
B						
C						
D						

Key:

(0) is the worst and (10) is the best

10 - excellent , 9- highly acceptable , 8- acceptable ,7- moderately acceptable , 6- slightly acceptable , 5- slightly unacceptable , 4-Moderately unacceptable , 3- unacceptable ,2- highly unacceptable ,1 and zero are rejected.

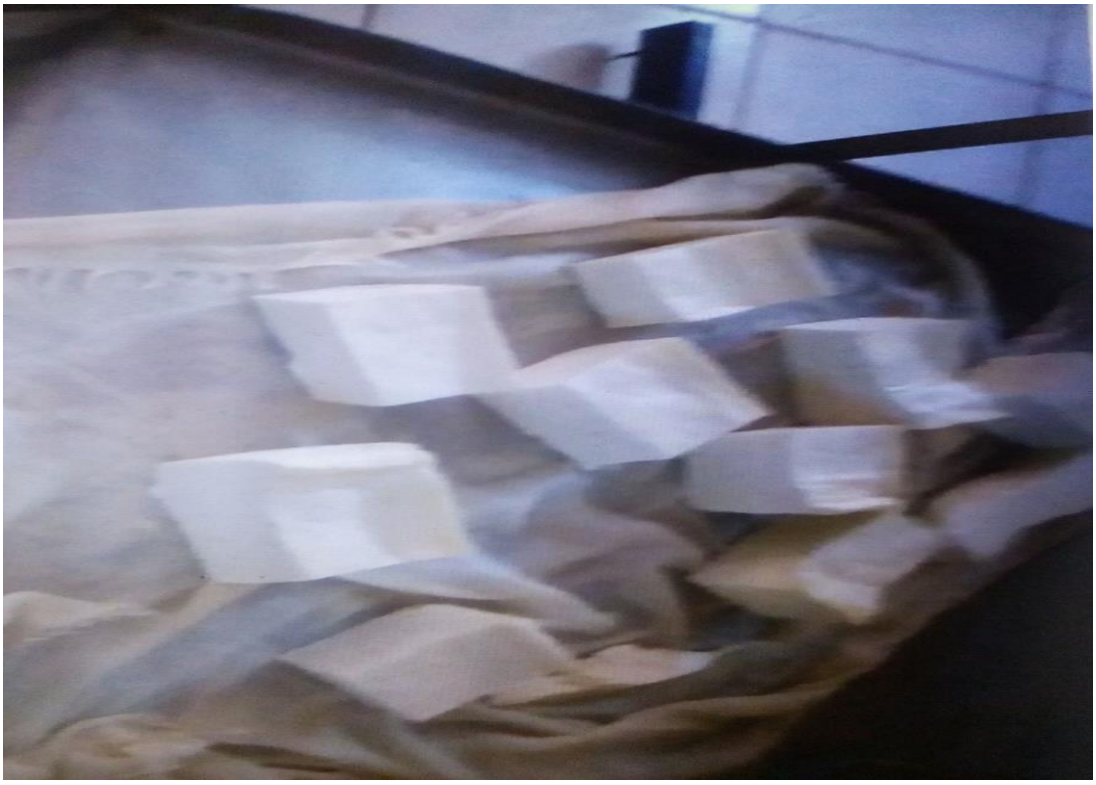
Were :-

A≡ Goat enzymatic cheese B≡ Goat acidic cheese

C≡ Cow enzymatic cheese D≡ cow acidic cheese

Acidic **cow’s cheese**

enzymatic (rennet)Goat’s cheese



Enzymatic (rennet) Cow's cheese using

Acidic(citric) Goat's cheese

Fig:1

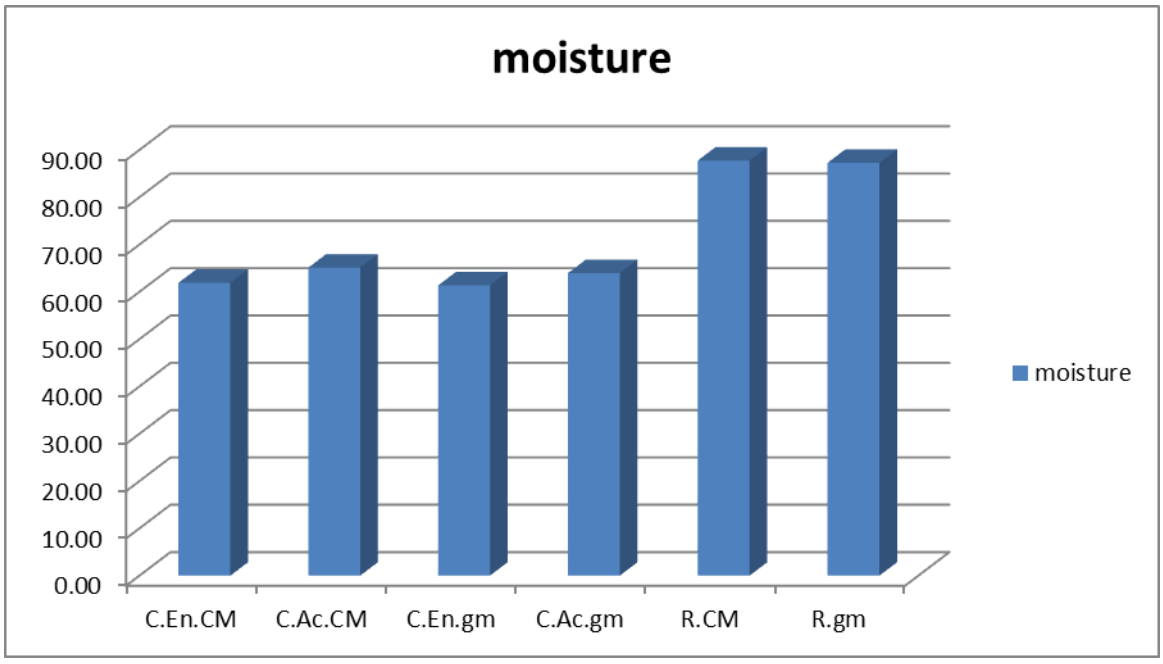

moisture
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
C.En.CM
C.Ac.CM
C.En.gm
C.Ac.gm
R.CM
R.gm
moisture

Fig:2

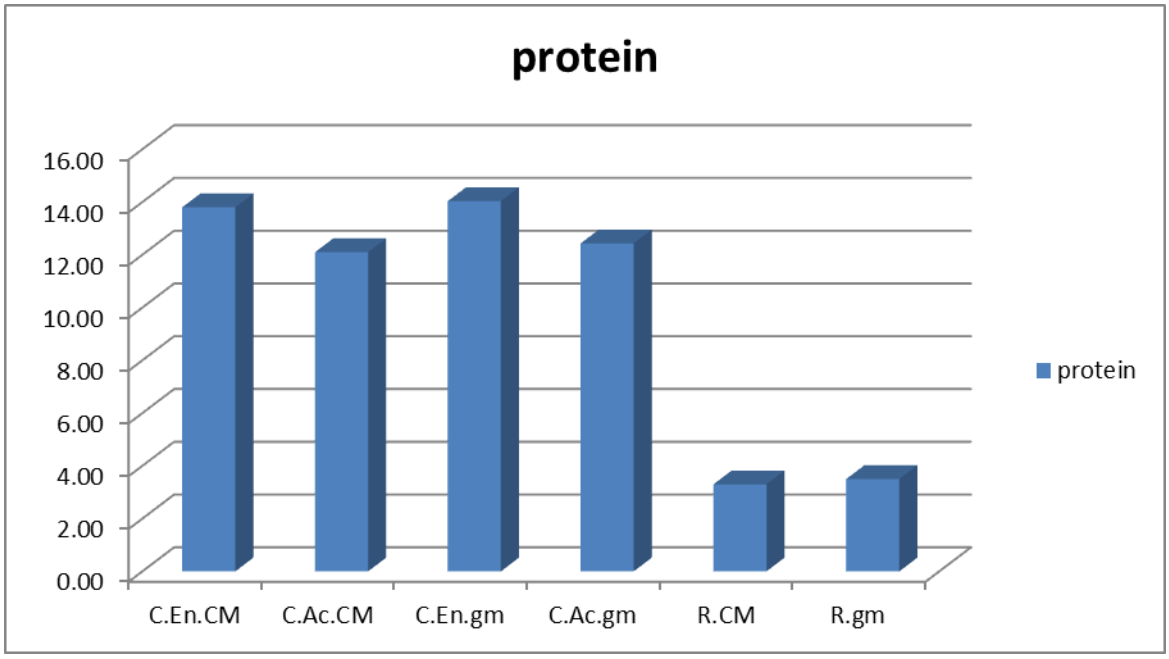

protein
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
C.En.CM
C.Ac.CM
C.En.gm
C.Ac.gm
R.CM
R.gm
protein

Fig:3

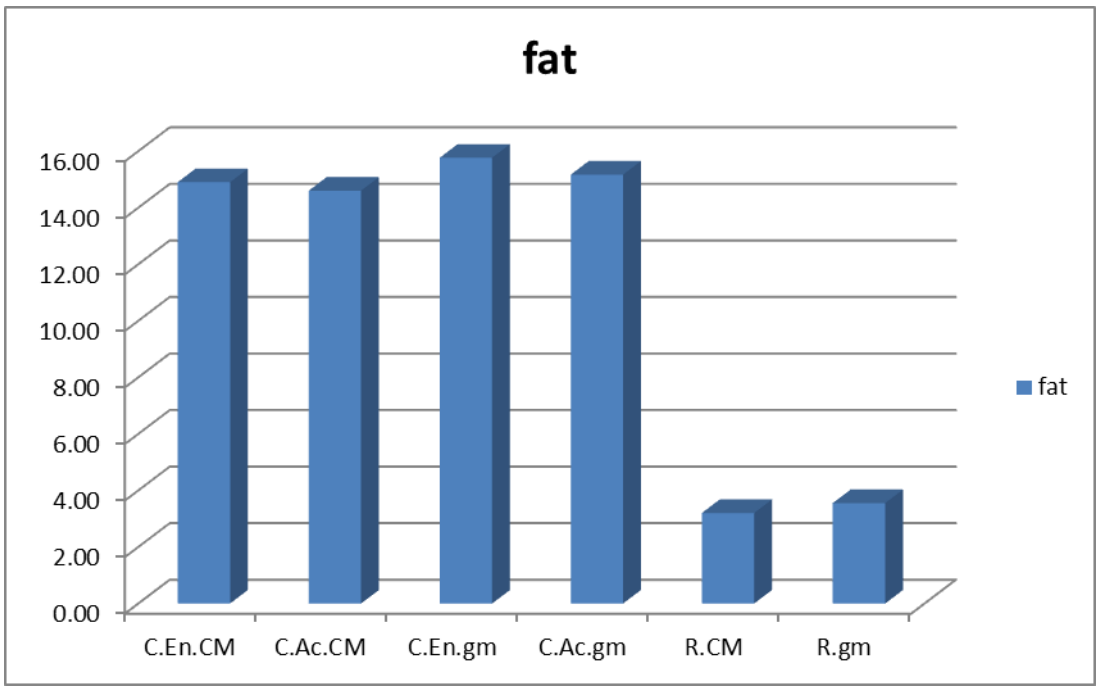

fat
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
C.En.CM
C.Ac.CM
C.En.gm
C.Ac.gm
R.CM
R.gm
fat

Fig:4

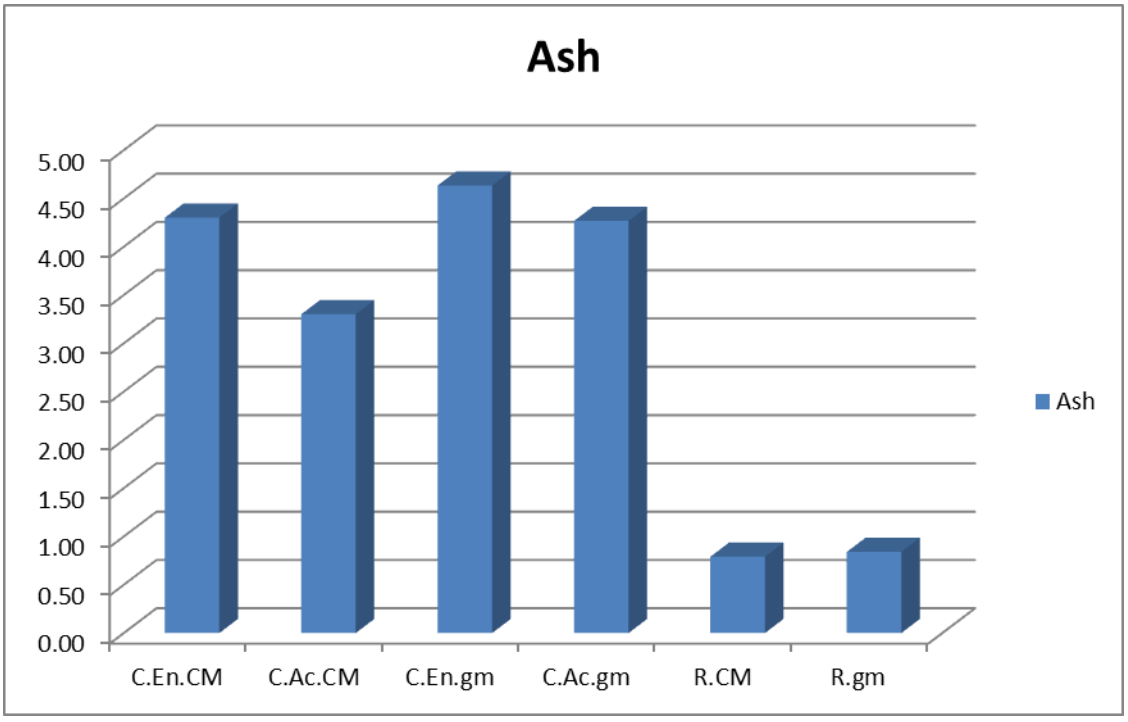

Ash
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
C.En.CM
C.Ac.CM
C.En.gm
C.Ac.gm
R.CM
R.gm
Ash

Fig:5

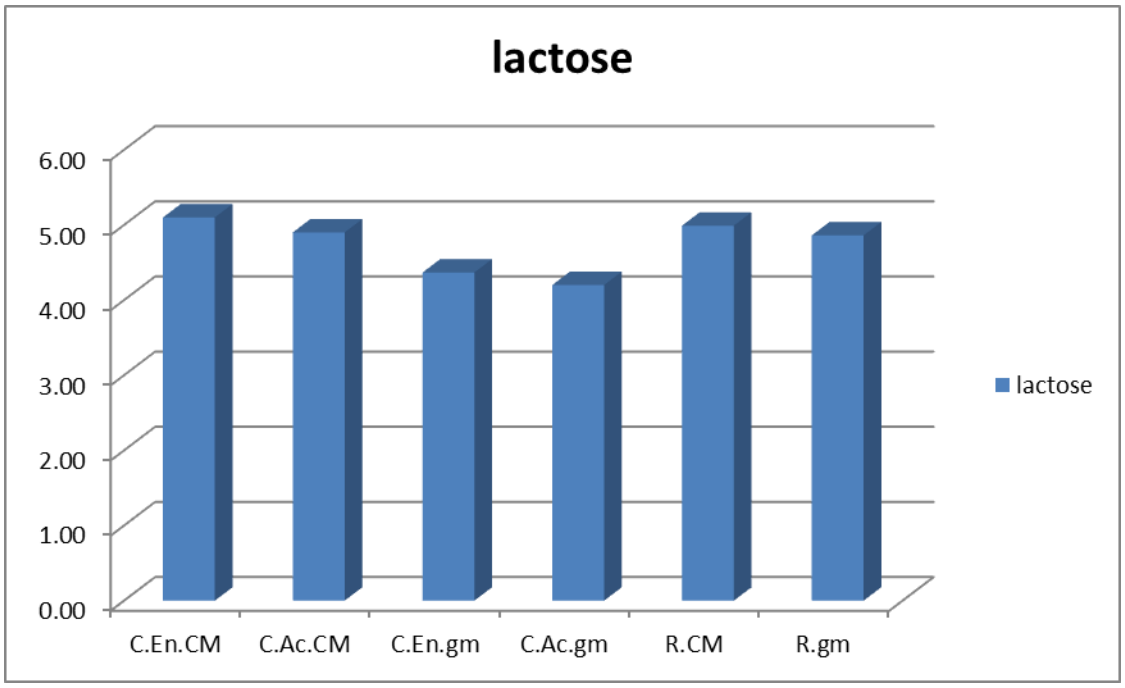

lactose
6.00
5.00
4.00
3.00
2.00
1.00
0.00
C.En.CM
C.Ac.CM
C.En.gm
C.Ac.gm
R.CM
R.gm
lactose

Fig:6

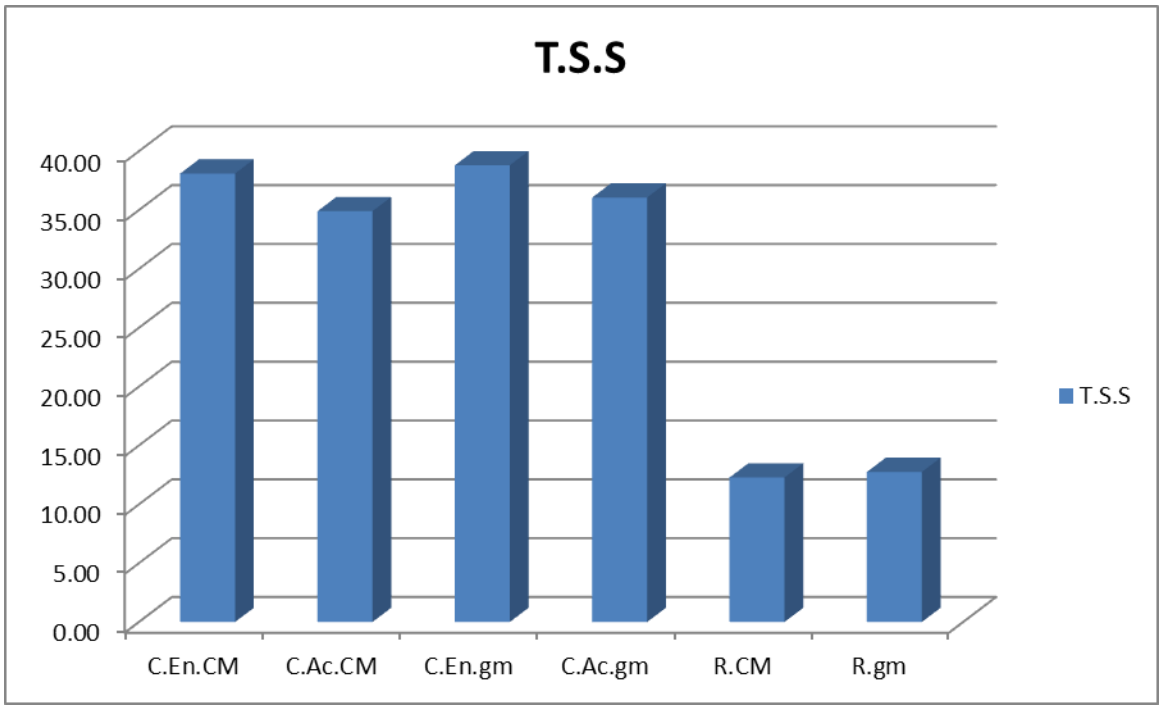

T.S.S
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
C.En.CM
C.Ac.CM
C.En.gm
C.Ac.gm
R.CM
R.gm
T.S.S

Fig:7

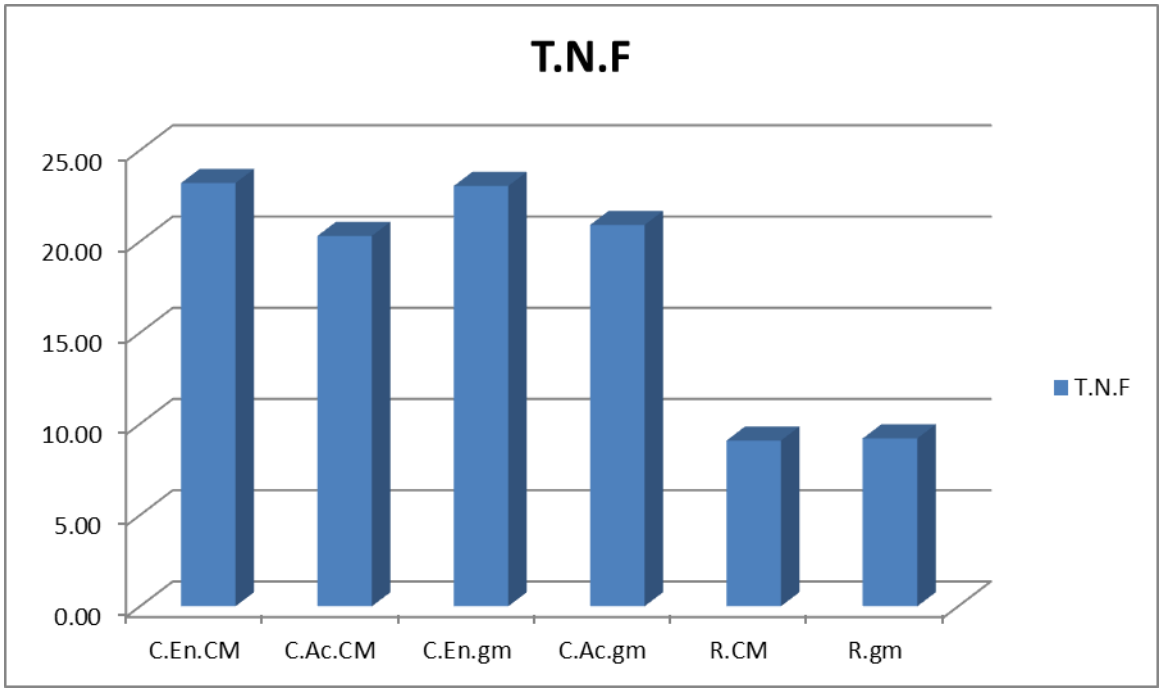

T.N.F
25.00
20.00
15.00
10.00
5.00
0.00
C.En.CM
C.Ac.CM
C.En.gm
C.Ac.gm
R.CM
R.gm
T.N.F

Fig:8

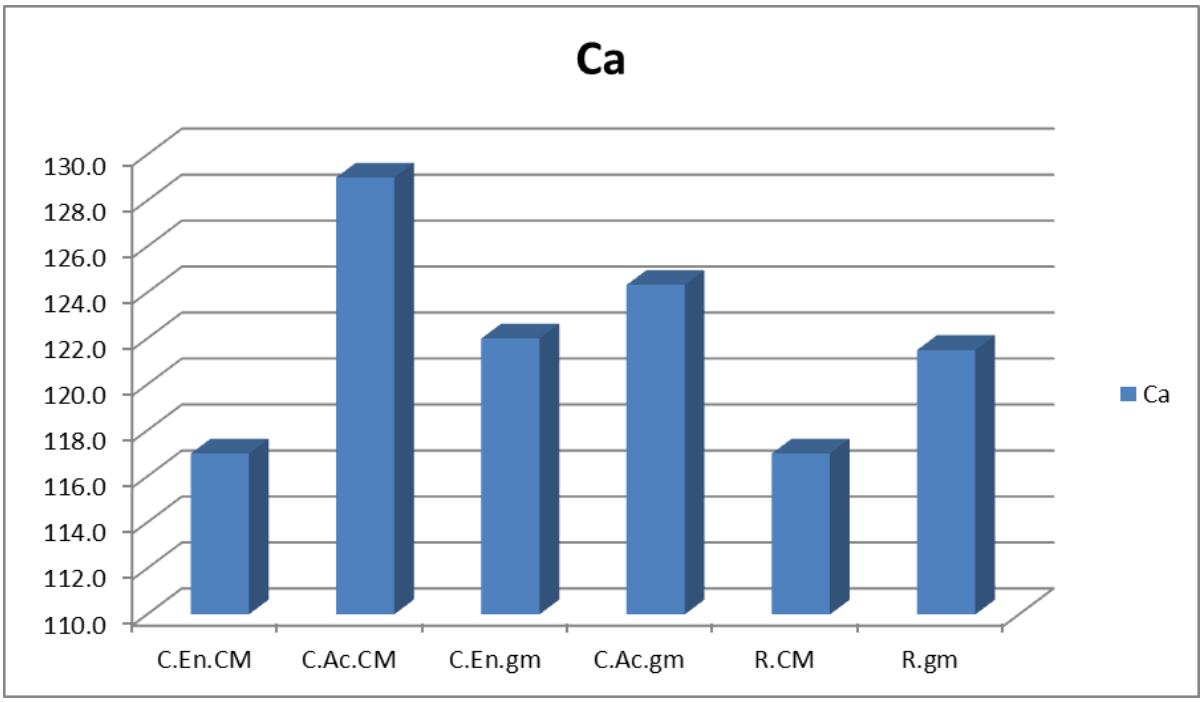

Ca
130.0
128.0
126.0
124.0
122.0
120.0
118.0
116.0
114.0
112.0
110.0
C.En.CM
C.Ac.CM
C.En.gm
C.Ac.gm
R.CM
R.gm
Ca

Fig:9

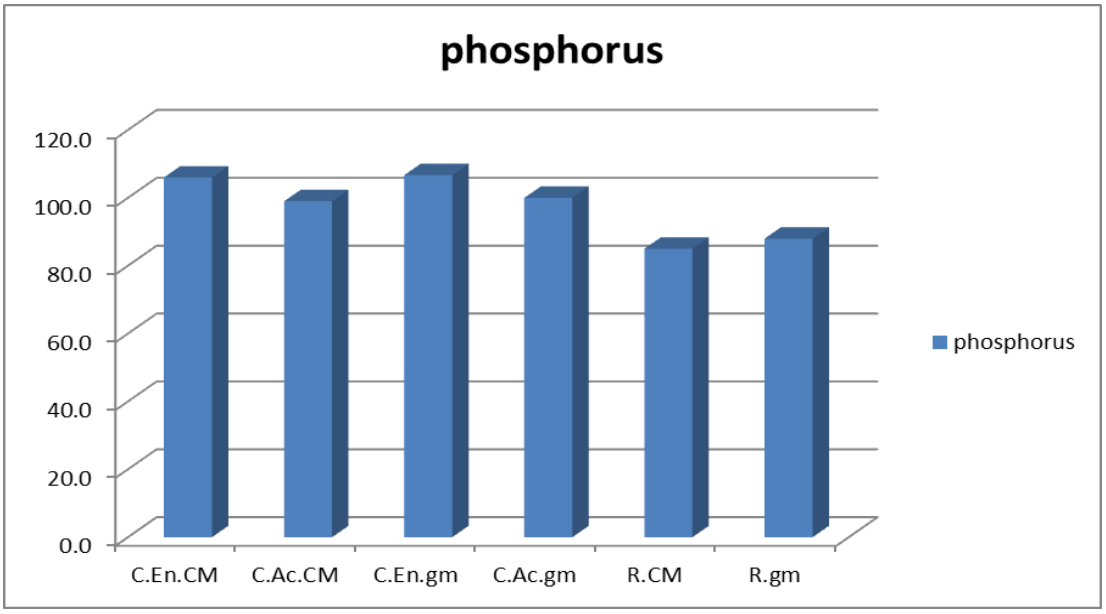

phosphorus
120.0
100.0
80.0
60.0
40.0
20.0
0.0
C.En.CM
C.Ac.CM
C.En.gm
C.Ac.gm
R.CM
R.gm
phosphorus

Fig:10

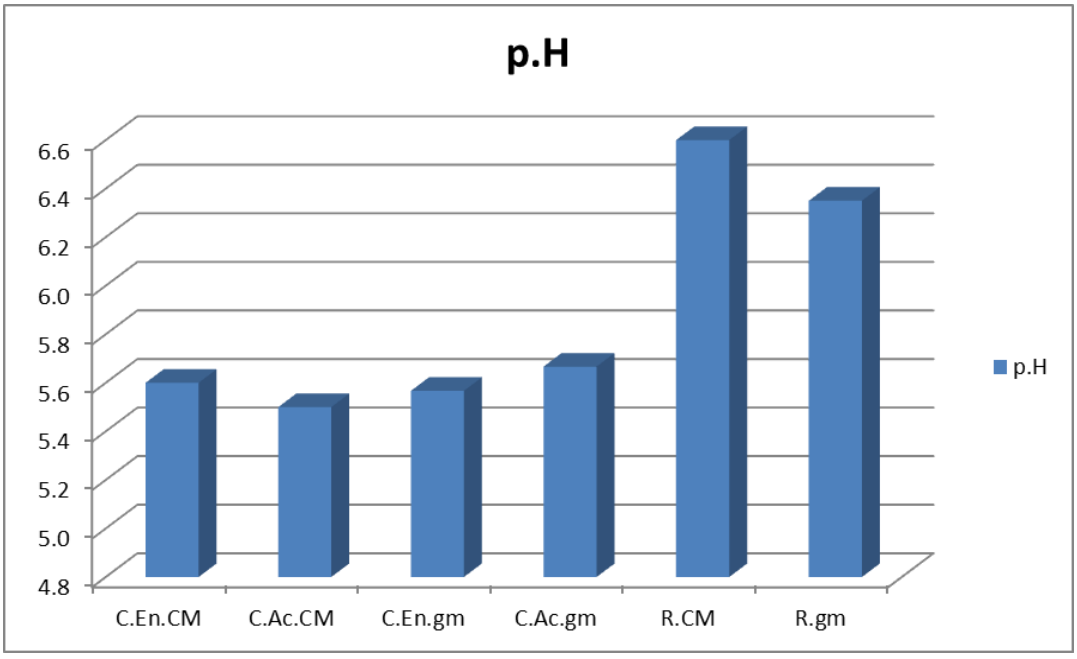
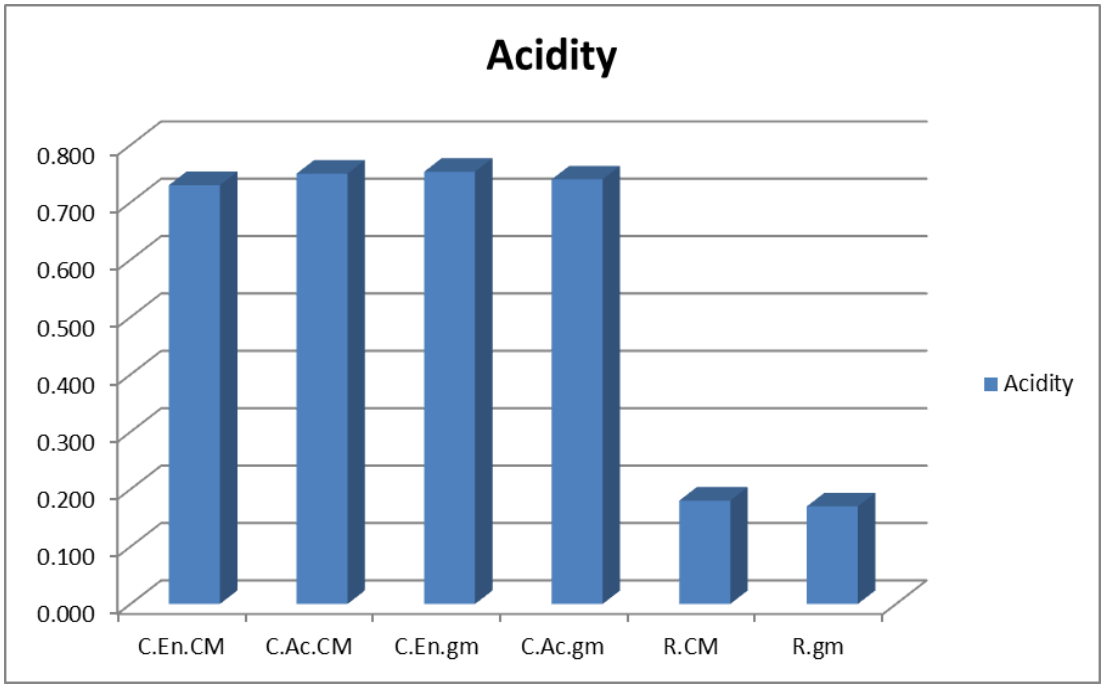

p.H
6.6
6.4
6.2
6.0
5.8
5.6
5.4
5.2
5.0
4.8
C.En.CM
C.Ac.CM
C.En.gm
C.Ac.gm
R.CM
R.gm
p.H

Fig:11


Acidity
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
C.En.CM
C.Ac.CM
C.En.gm
C.Ac.gm
R.CM
R.gm
Acidity

Conclusion

The present study aiming at making a comparison between the cow's and goat's cheeses on the quality and chemical composition of white soft cheese and also physical analysis of the cheese.

The quality characteristics studied were flavor and texture, Color,smell and general acceptability of enzymatic and acidic cheese of cow's and goat's milk respectively, where the chemical parameters analyzed were moisture content,acidity,fat,total solids content and protein content of white soft cheese.

It was found that the use of Rennet enzyme and Lemmon (citric Acid)

The results obtained from this study revealed that the short time of coagulation when using Lemmon (citric Acid) than when using Rennet enzyme in the two types used in the current study.

The processing of white soft cheese increasing the yield with increasing the chemical composition of white soft cheese(fat, protein, total solids) was increased with except for the acidity and moisture content.

5.1 Recommendations:

1. It's possible to use lemon (citric Acid) for cheese coagulation processing because of its availability and low price.
2. future studies on the subject area should cover the following aspects:
3. Development of simple technique for commercial white soft cheese production is needed.
4. As the goat production plays an important role in the improvement of income for poor families in rural areas and contributing positively in poverty alleviation programs, the new techniques have to use to help the farmers in rural area's economic by use Lemmon (citric Acid) in coagulation of white cheese (gibna baida) processing.\

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